ATARI®400/800™

COMPUTER PROGRAM

MUSIC COMPOSER™

ATARI®

A Warner Communications Company

Model CXL4007
Use with
ATARI® 400™ or ATARI 800™
PERSONAL COMPUTER SYSTEMS

General Information About the MUSIC COMPOSER™ Cartridge

Age Range: AGES 8 TO ADULT

This cartridge allows the user to:

- Input up to 10 phrases of music in any of three octaves from the computer keyboard.
- Play back phrases, or arrange combinations of phrases for as many as four simultaneous "voices."
- Modify music, including notes, volume, tempo and key and time signatures.
- Store/retrieve music on/from either cassette tape or floppy disk.

It develops skills in:

- Listening and memory.
- Auditory and visual perception.
- Understanding of and practice using music notation.
- Creating original melodies, harmony, and counterpoint.
- Finding patterns and understanding musical relationships.
- Designing complex (musical) structures from simple parts—an important skill in learning to write computer programs.

It encourages:
- Logical Thinking
- Experimentation/Exploration
- Creative Play
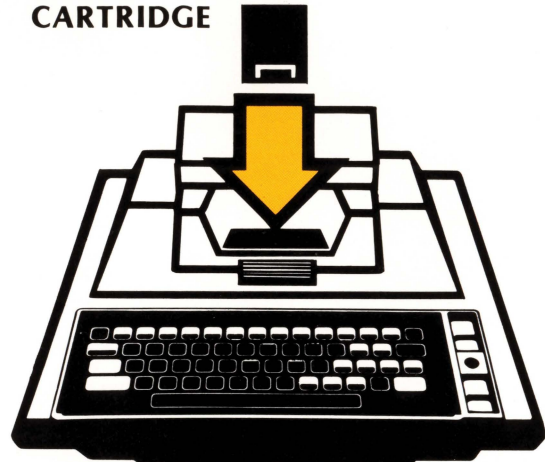- Music Appreciation

Categories of Use:
- Education
- Recreation
- Personal Development

Number of Users: 1

No additional accessories are required*

*An **ATARI® 410™** Program Recorder or an **ATARI 810™** Disk Drive is recommended. One of these is needed to store music for later use.

INSERTING THE CARTRIDGE

This cartridge runs on the **ATARI 400™** or the **ATARI 800™** Personal Computer System. On the **ATARI 800** system, insert the cartridge in the **LEFT CARTRIDGE** slot. Be sure the **POWER ON/OFF** switch on the right side of the console is **ON.** The **ATARI 400** and **ATARI 800** systems automatically shut off whenever the cartridge door is lifted. This prevents damage to the computer and to the cartridge.

The power indicator light on the console should be on when the power is **ON** and the cartridge door is closed, and off when the door is open.

NOTE: When using an **ATARI 810™ Disk Drive** with this cartridge use the following procedure:

- Make sure the Disk Drive is properly connected to the computer console.
- Turn the Disk Drive power switch **ON.**
- Insert a floppy disk into the Disk Drive.
- Insert the cartridge and turn the console power switch **ON.**

CARTRIDGE

ATARI 400™

CARTRIDGE

ATARI 800™

TABLE OF CONTENTS

HOW TO USE THIS MANUAL

This manual is in four parts. **PART ONE** is a general description of the **ATARI MUSIC COMPOSER** program. **PART TWO** is a step-by-step tutorial on how to use the cartridge.

The best way to use this manual is first, read all the way through **PART ONE**. This will give you a general idea of what the cartridge is about. Don't worry about the specific details. They will come later.

After you have read **PART ONE**, follow the instructions in **PART TWO**. It will take you through a sample session, and show you exactly how to use the cartridge. From time to time, you will want to refer back to **PART ONE** for more detail. And, eventually, you should read completely through **PART ONE** at least one more time.

Advanced users may want to skip **PART ONE** altogether in order to get immediately into a "hands-on" session in **PART TWO**. However, **PART ONE** should eventually be read by all users. Also for advanced users, **PART THREE** describes the music file storage format, and how to manipulate the files with external **BASIC** programs. Example **BASIC** programs to generate notes and to write harmony lines for a given melody are included.

PART FOUR of this manual is a brief listing of each of the commands, and of each of the file formats. This section is intended as a quick look up reference after you are familiar with the commands.

NOTE: The **MUSIC COMPOSER** Cartridge does not explain how to read and write music. A list of references for that purpose is included at the end of this instruction manual. This cartridge is intended for use by those who wish to experiment, or by those who are familiar with basic music notation. It may however, be a useful tool for those who wish to learn about music when used in combination with other reference material.

I. PART ONE

GENERAL DESCRIPTION OF THE ATARI MUSIC COMPOSER

A. WHAT DOES IT DO?

The **ATARI MUSIC COMPOSER** Cartridge will enable you to enter music for up to ten phrases into the computer. You can then listen to your music while you see it displayed on the video screen. You can change any note of any measure of the music you have written. The computer will correctly accept music written in any key. If you prefer, it will check for the proper number of beats per measure for different meters.

You can quickly and easily change the tempo of your music. After you have entered your music into the computer, you can arrange the music to play the different phrases in the order you choose. Up to four "voices" can be played at once. Music can be transposed*, and it can be played at dif-

*Transposition is done by a given number of half steps for each note in a phrase. See the **ARRANGE MUSIC** section for more information.

ferent volumes. You can display any single line of music on the video screen while the music is playing. Or, you can display a line of music that does NOT play, while you play another instrument along with the computer.

Once you have entered your music into the computer's memory, you can save all or part of it on cassette or disk. Since the music is stored as a list of numbers on the cassette or disk, you can also write **BASIC** programs that will change the music you have written. For example, you can convert a melody line into melody plus harmony. You can even write **BASIC** programs to "compose" music by rules you devise.

B. THE MAIN MENU

The **ATARI MUSIC COMPOSER** Cartridge is a computer program that is arranged as a group of menus. When first started, the computer displays the Main Menu of six selections. These selection are:

```
ATARI MUSIC

EDIT MUSIC
ARRANGE MUSIC
SAVE
RETRIEVE
DOS
LISTEN

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WHICH?
```

Some of these selections will display a menu of their own. One of the commands for these sub-menus will always be "**STOP**" or "**S**," which will return you to the Main Menu. Some of the sub-menu commands will allow a third level of commands. These third-level commands also have a "**STOP**" or "**S**" command that returns you to the sub-menu. Another "**STOP**" command will call up and display the Main Menu.

This hierarchy of menus is at once very powerful and very straightforward to use—you don't need to memorize all the many commands available. You simply deal with the commands for your current section or subsection of the program.
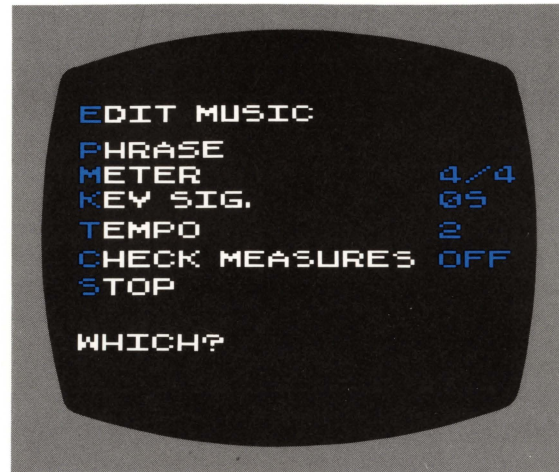
To select a menu item, type the first letter of the item, then hit RETURN . For example, to select **EDIT MUSIC**, type "**E** RETURN ". You can actually type it all out—"**EDIT MUSIC** RETURN "—if you like. The computer only looks at the first letter you type and ignores the rest.

You can "erase" letters by pressing the BACK SPACE key (DELETE BACK S), once for each letter you want to delete.

After you type your command, be sure to hit the RETURN key. That's the computer's signal to act upon what you have typed in the command line, and it won't do anything until RETURN is pressed.

EDIT MUSIC

Typing "**E** RETURN " from the main menu, to **EDIT MUSIC**, immediately causes another menu to be displayed. This is actually a combination of a command menu and current status. The menu selections appear on the left with their status values to the right. The display looks like this:

```
EDIT MUSIC
PHRASE
METER              4/4
KEY SIG.           05
TEMPO              2
CHECK MEASURES     OFF
STOP

WHICH?
```
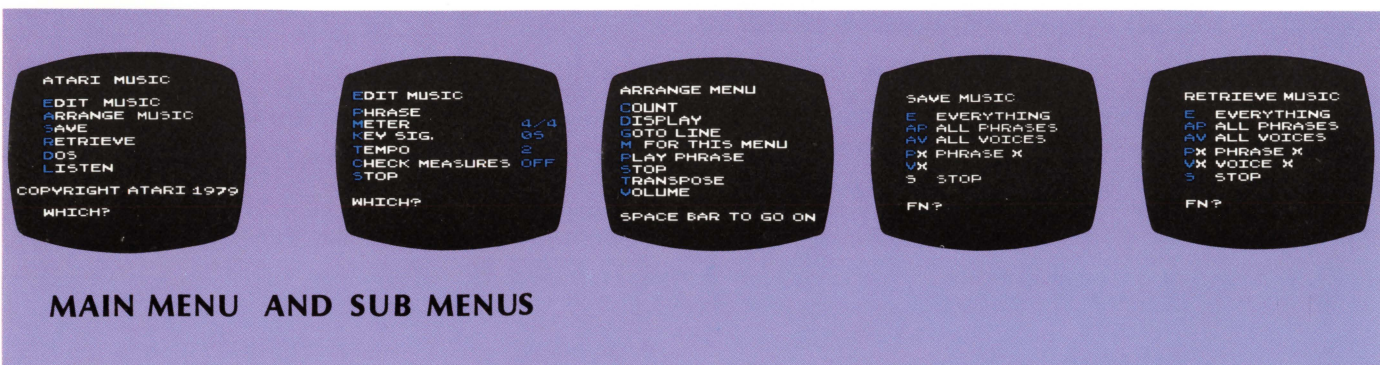
These commands allow you to change music that has already been entered into the computer memory. Or they allow you to more easily enter unusual musical formats. Change **PHRASE** allows you to enter new music, or to edit notes already in memory. Change **METER** and **CHECK MEASURES** help you keep track of the durations in a measure of music. **KEY SIG.** allows you to change music already entered to display (but not play) in any key, or to enter new music written in a key other than C major (or A minor). **TEMPO** changes the speed at which the music is played by the computer. And **STOP** returns you to the Main Menu.

Change Phrase

This command allows you to enter your music into the computer memory, or to edit notes already in memory.

When you type "**P** RETURN " for change **PHRASE**, the computer will ask "PHRASE #?". There are ten **PHRASE** numbers, 0 to 9. These allow you to label the different musical sections so you can manipulate them later with the "**ARRANGE**" command. You must type one of the digits, **0-9**, and RETURN .


```
ATARI MUSIC          EDIT MUSIC          ARRANGE MENU         SAVE MUSIC              RETRIEVE MUSIC
EDIT MUSIC           PHRASE              COUNT                E   EVERYTHING          E   EVERYTHING
ARRANGE MUSIC        METER          4/4  DISPLAY              AP  ALL PHRASES         AP  ALL PHRASES
SAVE                 KEY SIG.       05   GOTO LINE            AV  ALL VOICES          AV  ALL VOICES
RETRIEVE             TEMPO          2    M FOR THIS MENU      PX  PHRASE X            PX  PHRASE X
DOS                  CHECK MEASURES OFF  PLAY PHRASE          VX                      VX  VOICE X
LISTEN               STOP                STOP                 S   STOP                S   STOP
                                         TRANSPOSE
COPYRIGHT ATARI 1979 WHICH?              VOLUME               FN?                     FN?

  WHICH?                                 SPACE BAR TO GO ON
```

MAIN MENU AND SUB MENUS

Next, the computer will ask "ERASE?". If you wish to erase all previous measures in the **PHRASE**, as when you are entering new music, type "**Y** RETURN". Type "**N** RETURN ", or just RETURN if you DO NOT wish to clear the **PHRASE**.

If you do not erase the **PHRASE**, the computer will ask "**MEASURE #?**", so you can edit any previously entered measure (or enter any measure # for a new **PHRASE**). You would type the measure number and RETURN . If you do erase, the computer puts you directly in **MEASURE #1**, after it has cleared the **PHRASE**.

Next, the computer displays two music staves. These are the standard piano staves, with the treble clef on the top staff and the bass clef on the bottom staff. Each octave range is indicated by a different background color. Unless previously changed, the key will be C major (i.e., no sharps or flats), and the meter will be 4/4 time. The dark vertical bar positioned just after the time signature is called the "cursor". This is where the next note you write will be entered. As you enter notes, the measure will be played, and the cursor will move to the right.

Three numbers are under the music staves. They tell you which **PHRASE** you are in (**PHRASE ###**), which measure of that **PHRASE** (**MEASURE ###**), and the remaining free memory space, expressed as the number of notes that can still be stored (**#### FREE**).

On the last line of the screen is the prompt "SMI, NOTE?". This is a sort of compressed "reminder" menu, all scrunched down to one line. It is an abbreviation for:

Stop
Measure #
Insert measure
enter next NOTE

So, if you want to return to the **EDIT MUSIC** menu, you type "**S** RETURN ". To go to the next measure or to any other previously entered measure, type "**M#** RETURN ", only instead of typing "#", type the actual measure number, as "**M12** RETURN ".

If you want to insert a new measure somewhere in your music, say between measures 2 and 3, first type "**M3** RETURN ". Measure 3 will be displayed and will play. Next, type "**I** RETURN ". This will "push" all measures from measure 3 (where you are) to the last measure in that **PHRASE**, up one measure. What was measure 3 is now 4, what was measure 4 is now measure 5, and so on. Measures 1 and 2, below the Insert command, are not changed. Only measures above the Insert are moved. And the new measure 3 is empty, and ready for you to enter notes into it.

How to Enter Notes

To enter a note you must give the computer several pieces of information. First, you must tell it the letter name of your note: C, D, E, F, G, A, B, or R (rest). You may indicate a sharp or a flat or a natural by following the letter name with "S" or "F" or "N". An accidental (sharp, flat, or natural) will change all of the same notes following, until the end of the current measure, or until another accidental for the same note is entered in the same measure.

Next, you tell the computer which octave the note is in. This is a number between 3 and 6. Octave 3 starts with the C below middle C. Octave 4 starts with middle C. Octave 5 starts with the C above middle C. And Octave 6 starts and ends with the C above that, "high C".

You only need to enter the Octave Number to change octaves. If you do not enter an Octave Number, the computer

continues to use the last one it was given, even after the current measure is completed.
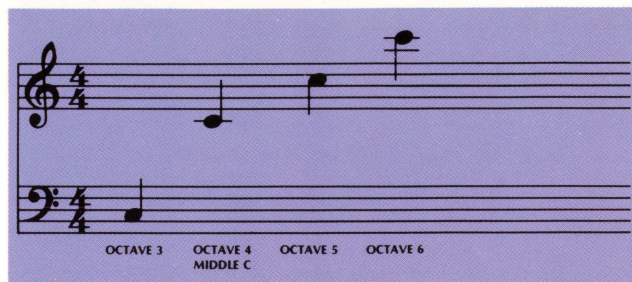

Durations go from whole notes to thirty-second notes:

W = ○ = Whole note
H = ♩ = Half note
Q = ♩ = Quarter note
E = ♪ = Eighth note
S = ♪ = Sixteenth note
T = ♪ = Thirty-second note

Note values may be followed by a dot, ".", to make them ½ longer than normal. If you wish to tie (or slur) the note to the one that will follow, type "T". This appears as a tie "(⌣)" on the screen, and it will cause the note to continue to sound until the next note is started. Normally, without the tie, there is a small space of silence between each note.

Some examples:
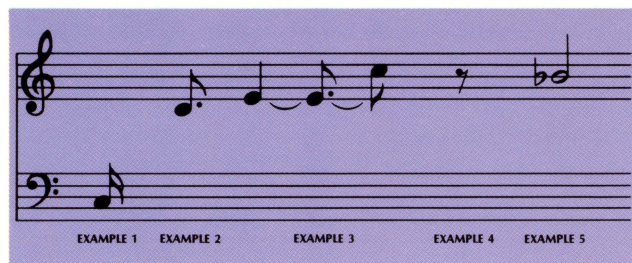
(1) Low C, a sixteenth note.
     Type: **C3S** RETURN

(2) Middle C, a dotted eighth note.
     Type: **C4E.** RETURN

(3) E above middle C, a quarter note tied to—
     E above middle C, a dotted eighth note slurred to—
     C above middle C, an eighth note.
     Type: **E4QT** RETURN
           EE.T RETURN
           C5E RETURN

(4) An Eighth rest.
     Type: **RE** RETURN

(5) Bb above middle C, a half note.
     Type: **BF4H** RETURN

To sum up, the format for entering a note is:
LETTER (**A**CCIDENTAL) **O**CTAVE **D**URATION (DOT) (TIE)

Accidental, Dot and Tie are options and may be left out. If Octave is not entered, the computer uses the last Octave Number it was given. Letter and Duration are not optional and must be included.

The format for entering a rest is:
R DURATION (DOT)

Dot is an option that, as for note durations, will cause the rest to be half again as long. "R" (for Rest) and Duration must be included.

Cursor Control Keys

The cursor control keys allow you to insert new notes between existing notes, or to delete notes. The keys are:

CTRL ←	move cursor left
CTRL →	move cursor right
CTRL DELETE	delete one note
CTRL CLEAR	delete all notes in this measure

The CTRL key must be held down while depressing the cursor control keys. New notes will always be inserted just before the cursor. Therefore, to insert a note between existing notes, use the CTRL ← or CTRL → to position the cursor just after where you want the new note to be inserted. Then enter the note in the normal way.

CTRL DELETE will always delete the note that is within the dark cursor area. To delete a note, use CTRL ← or CTRL → to position the cursor exactly on the note you wish to delete. Press CTRL DELETE , and the note is gone.

CTRL CLEAR will always delete all notes in the measure, regardless of where the cursor is. Press CTRL CLEAR and the measure will be empty of notes.

Change Meter/Check Measures

Since the computer doesn't have to keep time with anybody but itself, it really doesn't care what meter you use. You can make any measure contain any number of notes. It won't get confused and miss beats, as a human performer might do. But if you wish to stay within a particular meter, you can have the computer perform a measure check while you are entering notes under the "EDIT MUSIC" command.

While in the "EDIT MUSIC" menu, typing "C RETURN ", for "CHECK MEASURES", will cause the status word to change from "OFF" to "ON", or from "ON" to "OFF". If the CHECK MEASURES status is "OFF", then it will have no effect, nor will "METER". If CHECK MEASURES is "ON", then while you are entering notes the computer will not allow you to leave your current measure until the number of beats is correct. If the number of beats is incorrect, it will say "MEASURE TOO SHORT" or "MEASURE TOO LONG". There is an exception: In the first and last measures, you may have fewer than a full measure of beats.

The command "M RETURN " for change METER allows you to set the number of notes per measure. 4/4 sets four quarter notes per measure. The computer will allow any combination of notes or rests that is equivalent to four quarter notes per measure. One whole note, for example. Or two eighth notes, one quarter note, and one half rest. A meter of 2/4 will allow the equivalent of 2 quarter notes per measure. That could be one half note. Or one quarter note and one quarter rest. Or sixteen thirty-second notes.

Once your music has been entered into the computer memory, the Change TEMPO/CHECK MEASURES commands have no further effect. These commands are only an aid to help you enter music into memory correctly. They do not affect how the computer plays the music.

Change Key

Key signatures are normally written as a number of sharps (#) or flats (b) on the staves between the clef and the time signature. For example:

Key of D Major (or of B Minor)   **Key of G Major** (or of E Minor)   **Key of Eb Major** (Or of C Minor)

The Change Key command (**KEY SIG.**) allows you to enter music in the key in which it was written, even if you aren't sure what the key is. Before entering your music, simply count the number of sharps or flats in the key signature. Then, from the "EDIT MUSIC" menu, type "K RETURN ". The computer will respond with "NEW KEY SIG.?". You type the number of sharps or flats, and then "S" if they were sharps or "F" if they were flats, and RETURN . In the above three examples you would type "2S RETURN " for the first, "1S RETURN " for the second, and "2F RETURN " for the third. The computer will accept and display music in the proper key.

Changing the key signature AFTER music has been entered in memory will cause it to be displayed in the new key. However, it will still play in the original key.

Change Tempo

You can have the computer play your music faster or slower with the Change **TEMPO** command. There are 9 tempos, numbered from 1 to 9. A tempo of 1 is fastest, a tempo of 9 is slowest. You can change tempo any time you wish, before or after entering music. From the "EDIT MUSIC" menu, type "T RETURN ". The computer will respond with "NEW TEMPO?". Type the tempo you want, 1 to 9, and RETURN . The new tempo will be entered and you will see it as a status number after the word "TEMPO" in the menu.

ARRANGE MUSIC

After music has been entered into the computer memory, you can arrange or "program" how the computer is to play it. There are four voices, or sound channels, numbered 1 to 4. Each voice plays independently of the other three. This allows you to arrange, or program, each voice differently. Using the **ARRANGE** mode allows learning some important concepts of programming, too!

When you type "A RETURN " from the Main Menu, you are telling the computer you want to **ARRANGE MUSIC**. The computer will respond with "**VOICE #?**". You tell it which voice you want to arrange by typing the number, and RETURN . For example, "1 RETURN ". If this is the first time you have given the "ARRANGE MUSIC" command, the **ARRANGE MENU** will be displayed:


```
ARRANGE MENU

COUNT
DISPLAY
GOTO LINE
M FOR THIS MENU
PLAY PHRASE
STOP
TRANSPOSE
VOLUME


SPACE BAR TO GO ON
```

If you press the space bar (or any other key), the menu will be replaced by the **ARRANGE VOICE** program. This is a list of 20 numbered lines. On the bottom line are the letters "CDGMPSTV".

The numbered lines are the 20 program steps available for each voice. The letters correspond to the first letter from the **ARRANGE MUSIC MENU** selections. To display the menu again, type "M [RETURN]". Hit the space bar, and you are back again with the 20 program steps.

After the first time you call "ARRANGE MUSIC" from the Main Menu, the **ARRANGE MENU** will NOT be displayed. Instead, you will immediately get the 20 program steps for the voice you asked for. If you want to see the **ARRANGE MENU**, just type "M [RETURN]".

When you are ready to return to the Main Menu, type "S [RETURN]", for "**STOP**".

All the other commands in the **ARRANGE MENU** are actually programming steps. They are not done when you type them in. Instead, they are entered as one of the 20 program steps. The computer will do all the steps you have programmed when you give it the "LISTEN" command from the Main Menu.

Display

DISPLAY tells the computer to display the notes of that voice as they are being played. While all four voices can play at once, only one voice can be displayed at a time.

The **DISPLAY** instruction selects which of the four voices will be displayed on the video screen. That voice will continue to be displayed until another voice receives a **DISPLAY** instruction. If two or more voices get the **DISPLAY** instruction at the same time, the lowest numbered voice will be displayed. To enter the **DISPLAY** command, type "D [RETURN]".

Play

PLAY (PHRASE) tells the computer to play a **PHRASE**. To enter the **PLAY** instruction, type "P [RETURN]". The computer will ask "PHRASE #?". Enter the number of the **PHRASE** you want it to play at that step, and [RETURN]. Any **PHRASE**, 0 to 9, may be entered at any of the 20 **ARRANGE** program steps, in any of the four voices.

The **PLAY** instruction is the only instruction that has a duration. Duration is the time the computer takes to play the **PHRASE**. All the other instructions have no duration. This means that in order to make phrases in different voices play together, you only count the **PLAY** instructions. Don't count the other instructions.

For example, suppose you have four phrases of music. The meter, or number of beats per measure, is the same for all. **PHRASE #1, PHRASE #2,** and **PHRASE #3** have four measures each, so they have the same duration. **PHRASE #4** has eight measures, so its duration is twice that of the other phrases—because eight measures take twice as long to play as four measures. Now, suppose your **ARRANGE** program looked like this:

VOICE #1	VOICE #2	VOICE #3
1 DISPLAY	1 PLAY PHRASE 2	1 PLAY PHRASE 4
2 PLAY PHRASE 1	2 DISPLAY	2
3 PLAY PHRASE 2	3 PLAY PHRASE 3	3
4	4	4

Since only the **PLAY** instruction has duration, **VOICE #1** will Display and Play **PHRASE 1** while **VOICE #2** plays **PHRASE 2** and **VOICE #3** plays the first half of **PHRASE 4**. Then **VOICE #1** will play **PHRASE 2** while **VOICE #2** Displays and Plays **PHRASE 3** and **VOICE #3** continues to play **PHRASE 4**. Then, since there are no more instructions, all the voices will stop.

To keep all this straight, you really only need to remember one rule: The **PLAY** instruction is the ONLY instruction that has duration. So, when you are deciding when each voice plays a **PHRASE**, only count the **PLAY** instructions. Don't count the other instructions.

Volume

VOLUME tells the computer how loudly you want phrases played. For each voice, the **VOLUME** instruction will affect all further **PLAY** instructions in that voice. The loudness won't change again unless the computer gets another **VOLUME** instruction for the same voice.

To enter the **VOLUME** instruction, type "V [RETURN]", when an **ARRANGE VOICE** program is on the screen. The computer will respond with "VOLUME?". Volumes are 0 (zero) for off, and the six standard loudness abbreviations, **PP, P, MP, MF, F,** and **FF.** The softest sound is **PP,** and the loudest is **FF.** You would give the computer one of these, and [RETURN].

If you don't use the **VOLUME** instruction, the computer will play all phrases at half loudness, **VOLUME MF.**

As an example, suppose you have two phrases of music. You want the computer to play **PHRASE 1,** but you want to play **PHRASE 2** on your flute. You want the computer to display **PHRASE 2,** but not to play it. Your **ARRANGE** program would look like this:

VOICE 1	VOICE 2
1 PLAY PHRASE 1	1 DISPLAY
2	2 VOLUME 0
3	3 PLAY PHRASE2
4	4

Now, **PHRASE 1** will play at half loudness while **PHRASE 2** is displayed on the video screen, but is not played. And your friends can see the notes you play as you "jam" with your computer.

Transpose

Music is transposed when it is played at a higher or lower pitch than it was written*. The **TRANSPOSE** instruction will do this for each voice. You can play a **PHRASE** of music unchanged in one voice, and play the same **PHRASE** transposed in another voice.

For each voice, the **TRANSPOSE** instruction will affect all further phrases in that voice until the computer finds another **TRANSPOSE** instruction in the same voice. To enter the **TRANSPOSE** instruction, type "T [RETURN]". The computer will respond with "#1/2 STEPS?". It will accept any number from -36 to 36. Positive numbers, numbers without the minus sign, transpose up. They make the music sound higher in pitch. Minus numbers transpose down. They make the music sound lower in pitch.

Each 1/2 step is equivalent to the pitch change from a note that is played natural, to the same note played sharp. Say D4 to DS4. Each minus ½ step—each ½ step down—is equivalent to the pitch change from a note that is played natural, to the same note played flat. Say, D4 to DF4.

As an example, suppose you want to play **PHRASE 1** as it was written, then play it transposed up one octave (12 1/2 steps),

*Note that this is not necessarily "transposition" in the standard musical sense. That is, it is not like "transpose up a major third" or "transpose down a fourth." The **MUSIC COMPOSER** transposes *each note* in the phrases that follow by exactly the number of half steps specified. Transposing a **PHRASE** in music from one key to another is somewhat more complicated than this.

then play it again as it was written. Your **ARRANGE** program would look like this:

```
1 DISPLAY
2 PLAY PHRASE 1
3 TRANSPOSE 12
4 PLAY PHRASE 1
5 TRANSPOSE -12
6 PLAY PHRASE 1
7
```

Step number 5, **TRANSPOSE -12**, takes the voice back to its original pitch (12-12=0). It is fairly easy to instruct the computer to **TRANSPOSE** music out of the computer's three octave playing range. When this happens, the computer will do the best it can, but the results can be surprising!

Goto/Count

These two instructions control the flow of your **ARRANGE** program. They are like iteration (repeat) loops in programming languages (e.g. the **FOR/NEXT** statements in **ATARI BASIC**). Normally, the computer will do each instruction in order, from step 1 to the last step of the program. The **GOTO** instruction changes that.

When the computer finds a **GOTO** instruction it goes to the line number in that instruction. For example, suppose you want to play **PHRASE 1, 2,** and **3**, then you want to play **PHRASE 2** and **3** over and over. Your **ARRANGE** program would look like this:

```
1 DISPLAY
2 PLAY PHRASE 1
3 PLAY PHRASE 2
4 PLAY PHRASE 3
5 GOTO 3
6
```

The computer will execute each instruction in order until it gets to line #5, which tells it to go to line #3. It goes to line #3 and does each instruction in order until it gets to line #5, which tells it to go to line #3. And so on. And so on.

This is called a "loop" (iteration) because it loops from line #5 back to line #3. And, because it never stops looping (unless you turn the computer off, or hit the `SYSTEM RESET` key), it is called an **infinite loop**.

To enter the **GOTO** instruction, type "G `RETURN` ". The computer will respond with "LINE #?". Type the line number you want it to **GOTO**, and `RETURN` . The line numbers must be between 1 and 20. If you should instruct the computer to **GOTO** a line number that does not contain an instruction, it could become confused when it tries to run your **ARRANGE** program. So be sure to always **GOTO** a line that has an instruction.

While the infinite loop **GOTO** instruction is fine for playing the same thing over and over, it's not good for much else. Suppose you want to play **PHRASE 1** three times, then play **PHRASE 2** twelve times, each time transposed by one 1/2 step, then play **PHRASE 1** again. To do something like this, the **GOTO** instruction has to be "smarter". And it is.

This is where you need the **COUNT** instruction. The **COUNT** instruction will tell the **GOTO** instruction how many times it should loop before going on to the next program line. An **ARRANGE** program to do the example above would look like this:

```
1 DISPLAY
2 COUNT 3
3 PLAY PHRASE 1
4 GOTO 3
5 COUNT 12
6 TRANSPOSE 1
7 PLAY PHRASE 2
8 GOTO 6
9 TRANSPOSE -12
10 PLAY PHRASE 1
11
```

Line 2 sets the **COUNT** to 3, so line 4 will loop back to line 3 three times. Then it goes on to line 5. Line 5 sets the **COUNT** to 12, so line 8 loops back to line 6 twelve times. Each time through the first loop, the computer plays **PHRASE 1**. It plays three times. Each time through the second loop, the computer transposes one 1/2 step and plays **PHRASE 2**. After the twelfth loop, it transposes back down to where it was at the start, and plays **PHRASE 1** a final time.

To enter the **COUNT** instruction, type "C `RETURN` ". The computer will ask "**COUNT #?**". Type the number of times you want the next **GOTO** instruction to loop, and `RETURN` . You can loop as many as 127 times. If you want to loop always (the infinite loop), enter a **COUNT** of -1.

If you do not use the **COUNT** instruction in your **ARRANGE** program, but you do use a **GOTO** instruction, the **GOTO** will assume a **COUNT** of -1, and it will be an infinite loop.

Edit Keys ⬆ ⬇ INSERT DELETE BACK S

When first powered up, **VOICE #1** will already have 2 program steps:

```
1 DISPLAY
2 PLAY PHRASE 1
3
```

These, or any other previously entered program steps can be changed (edited) by using the Edit Keys. Notice that one line number—line number 3 in the example—is darker than the other line numbers. It should be blue on a color TV. This is the current line cursor and it is where the next program step will be entered.

The four Edit Keys allow you to change the position of the current line cursor or to change what is in the current line. The Edit Keys are:

`CTRL` ⬆	move current line cursor up
`CTRL` ⬇	move current line cursor down
`CTRL` `DELETE`	delete instruction at current line
`CTRL` `INSERT`	insert instruction at current line

Whenever you type in an instruction it will be put into the line number that is shaded by the current line cursor. For example, if the cursor is on line number 3, and you want to change the instruction at line number 1, you use `CTRL` ⬆ to move up two lines. Hold `CTRL` down, then type ⬆ twice. Line 1 will now have the dark color. Any program step you enter will now go in this line. Anything already there will be replaced when you enter the new instruction.

If you want to delete what is on the current line and not enter anything in its place, type `CTRL` `DELETE` . This erases what was on the current line, and moves everything up one line to close up the gap. `CTRL` `INSERT` has the opposite effect. It will move everything down one line, including what was previously there. The current line will be empty, ready for you to insert a program step.

LISTEN

The **LISTEN** command tells the computer to run the **ARRANGE** program. A short **ARRANGE** program is automatically entered into the computer memory when it first starts the **MUSIC** cartridge. If you have not entered your own **ARRANGE** program, then this default program will run.

VOICE 1	VOICE 2
1 DISPLAY	1 PLAY PHASE
2 PLAY PHRASE 1	2
3	

This program plays Phrases 1 to 4 simultaneously through Voices 1 to 4. Also, it displays Voice 1. If any of these phrases are not in the computer's memory, it ignores that play instruction. This allows you immediately to **LISTEN** to music you have entered in any of the four Phrases, without stopping to write an **ARRANGE** program.

To "LISTEN" to your music, type "**L** RETURN ", from the Main Menu. The computer will display the two staves, and it will play your music according to the **ARRANGE** program— either the default program, or one you've entered. Then it will return to the Main Menu.

Save/Retrieve

These commands allow you to save and retrieve your music to and from external storage, usually cassette or disk. "**SAVE**" sends the music data from the computer memory out to external storage. "**RETRIEVE**" gets the data from external storage and puts it into the computer's memory. Except for this difference in the direction of the data flow, the two commands are alike.

When in the Main Menu, and you type "**S** RETURN " or "**R** RETURN " for "**SAVE**" or "**RETRIEVE**", the computer will respond with:

> SAVE (or RETRIEVE) MUSIC
>
> E EVERYTHING
> AP ALL PHRASES
> AV ALL VOICES
> PX PHRASE X
> VX VOICE X
> S STOP
>
> FN?

Before you go any further, you must respond to the computer's "**FN?**" prompt, which stands for "File Name?".

The response to this, if you have a cassette, is "**C:** RETURN ". If you have a disk drive, use standard **ATARI** disk file names, such as "**D:MYMUSIC.V3**". Refer to your Personal Computer Operator's Manual, your BASIC Manual, your Program Recorder Manual, or your Disk Operating System manual for more details on cassette or disk operation.

After you have correctly entered the File Name of your music data, the computer will ask "**WHICH?**". Type "**E** RETURN " to **SAVE** or **RETRIEVE** "**EVERYTHING**"—all music (Phrases) and all **ARRANGE** programs (Voices).

If you only want to **SAVE** or **RETRIEVE** the music and not the **ARRANGE** programs, type "**AP** RETURN ", for "**ALL PHRASES**". And if you only want one of the 10 Phrases, type "**PX** RETURN ". Only, instead of typing the "**X**", type one of the 10 PHRASE numbers, 0 to 9, such as "**P2** RETURN ", for example.

If you only want to **SAVE** or **RETRIEVE** the **ARRANGE** programs and not the music, type "**AV** RETURN ", for "**ALL VOICES**". And if you only want one of the 4 Voices, type "**VX** RETURN ". Instead of typing the "**X**", type one of the 4 Voice numbers, 1 to 4, such as "**V1** RETURN ".

The computer will ignore commands to **SAVE PHRASES** or **VOICES** that do not exist in its memory. And it won't **RETRIEVE** a **PHRASE** or **VOICE** that has not previously been saved. So, if you **SAVE** "**ALL PHRASES**", and then try to **RETRIEVE** "**EVERYTHING**", the computer will only **RETRIEVE** the phrases you had saved.

After you have **SAVED** or **RETRIEVED** your music, type "**S** RETURN ", for "**STOP**", and you are back in the Main Menu.

DOS

DOS stands for Disk Operating System, and is only used when you have a disk drive. Typing "**D** RETURN ", for DOS puts you in the **ATARI DOS** that was booted when you first turned on your system. The standard DOS commands are available, so you can examine the directory, and so on. Consult your ATARI DOS MANUAL for details.

Should you enter "**D** RETURN ", and you do not have a disk drive, the computer will put you in it's MEMO PAD mode. To return to the **MUSIC COMPOSER** Cartridge, press the " SYSTEM RESET " key.

II. PART TWO

A SAMPLE SESSION WITH THE ATARI MUSIC COMPOSER CARTRIDGE

A. ENTERING MUSIC

In this step-by-step session, you will enter the music for "Row, Row, Row Your Boat". This is a musical round, in which the music is repeated by each of the four voices in turn, each slightly behind the other.

With the computer off, insert the **ATARI MUSIC COMPOSER** Cartridge. If you are using the **ATARI 800** computer, use the **LEFT CARTRIDGE** slot. Turn on the computer. The program should display the Main Menu:
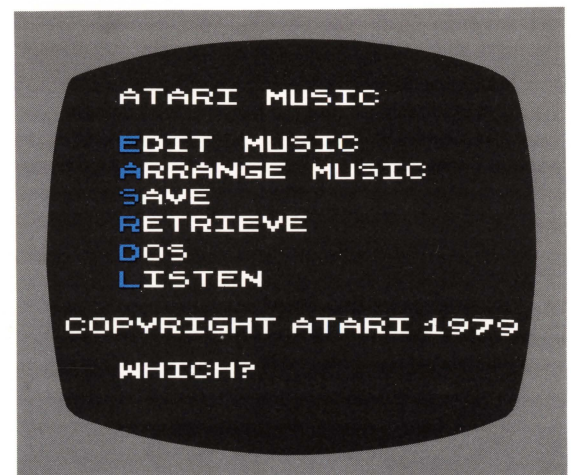
The first **PHRASE** of the music you will enter is:

Row, row, row your boat / Gently down the stream

And the second **PHRASE** is:

Merrily, merrily, merrily, merrily / Life is but a dream.

This will be new music, so you will enter the **EDIT MUSIC** command, and then erase all previous music in the **PHRASE**. Even though there may not have been any previous music entered, it's still a good idea to "clean the slate", so there won't be any surprises.

You type: **E** `RETURN`

The computer displays the **EDIT MUSIC** menu.
You: **P** `RETURN`

The computer asks: **PHRASE #?**
You: **1** `RETURN`
Computer: **ERASE?**
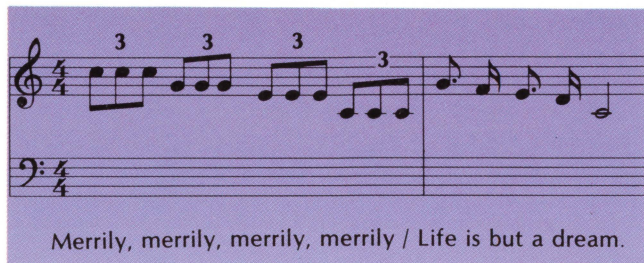You: **Y** `RETURN`

The computer displays the empty music staves. The bottom line of the display asks: **SMI, NOTE?**
You: **C4Q** `RETURN`

The computer displays the first note and plays it. It is Middle C, a quarter note, or, in terms the computer can understand, C (natural) of Octave 4, a Quarter note. Now, enter the second note.
You: **CQ** `RETURN`

The computer displays and plays both notes. They are both alike. You do not have to give the Octave number again until you wish to change to another octave.

NOTE: When using a dotted or tied sixteenth note however, you must specify the Octave number. This is necessary because the computer confuses the **S** for sixteenth, with the **S** for sharp.

The next note, the third note in the first measure of the first PHRASE, is a dotted eighth note.
You: **CE.** `RETURN`

Notice that each time you enter a note the computer displays and plays all notes in the measure. The next note is a sixteenth note.
You: **D4S** `RETURN`

The next note, the last note of the first measure, is a quarter note. But enter it as an eighth note, so you can go back and correct your "error".

PHRASE 1
MEASURE 2
10221 FREE
L (A) O D (.) (T)
SMI, NOTE?
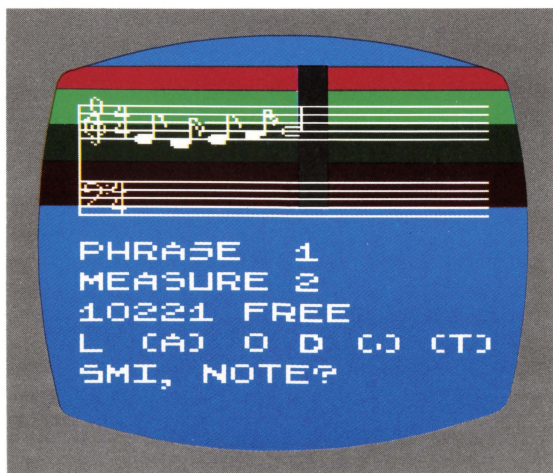
You: **EE** `RETURN`

Now, change the incorrect eighth note.
You: `CTRL` `←`

Note that "`←`" is pressed while you are holding down "`CTRL`". The action of the editing keys is immediate, and you don't have to type `RETURN` .

The display shows the incorrect eighth note outlined by the cursor. Zap the note.
You : `CTRL` `DELETE`

The measure is displayed and played, minus the zapped eighth note. Now enter the correct note.
You: **EQ** `RETURN`

The entire first measure is played and displayed. Just to become more familiar with the editing keys, try entering a note, say a High C half note, between the first two notes of the measure. First, move the cursor to just behind the first note.

You: `CTRL` `←`
    `CTRL` `←`
    `CTRL` `←`
    `CTRL` `←`

The cursor should be in position behind the first note. Now you can insert the extra note.
You: **C6H** `RETURN`

That should give you a High C half note sandwiched between the two Middle C quarter notes. It sounds terrible. Zap it.

You: `CTRL` `←`
    `CTRL` `DELETE`

Your measure is restored. Now go on to the 2nd measure.
You: **M2** `RETURN`

The two music staves are empty again, and the computer display says you are in **PHRASE 1, MEASURE 2**. Notice that every time you enter a note, or change measures, the "**### FREE**" message displays one number less. It counts down as you use up the available computer memory.

Enter the five notes of the second measure.
You: **E4E.** `RETURN`
   D4S `RETURN`
    EE. `RETURN`
   F4S `RETURN`
    GH `RETURN`

PHRASE 1
MEASURE 1
10227 FREE
L (A) O D (.) (T)
SMI, NOTE?
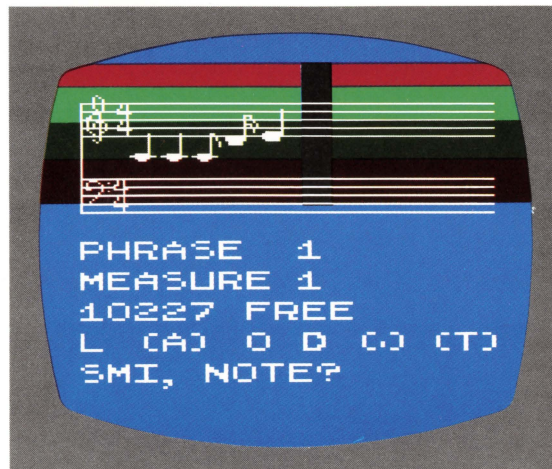
That gets you gently down the stream. Now go back to the Main Menu, and **LISTEN** to what you've entered so far.
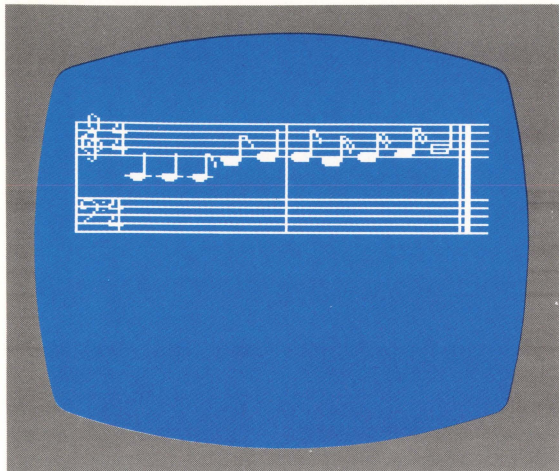You: **S** `RETURN` (STOP)

That puts you back in the **EDIT MUSIC** menu. Once again.
You: **S** `RETURN` (STOP)

The computer should display the Main Menu.
You: **L** `RETURN` (LISTEN)

That plays your music, and then returns you to the Main Menu. Do it again.

You: **L** `RETURN` **(LISTEN)**

Not bad. But suppose one of the notes was wrong. A note in the 2nd measure of **PHRASE 1**, for example. To change the note, when you enter "change **PHRASE**", you DO NOT respond with "**Y RETURN** " to the prompt "**ERASE?**" because this would wipe out your entire **PHRASE.**

You: **E** `RETURN`

The **EDIT MUSIC** menu is displayed. You want to change **PHRASE #1, MEASURE #2.**

You: **P** `RETURN`
Computer: **PHRASE #?**
You: **1** `RETURN`
Computer: **ERASE?**
You: **N** `RETURN` (We don't want to erase it this time!)
Computer: **MEASURE #?**
You: **2** `RETURN`

There you are, back in **MEASURE #2**. You could change a note, if it were really wrong, by using the edit keys, as you did before. Now go back to the Main Menu.

You: **S** `RETURN`

The **EDIT MUSIC** menu is displayed.
You: **S** `RETURN`

And you're in the Main Menu. Just for fun, **LISTEN** to your music again.

You: **L** `RETURN`

Now tackle the 2nd **PHRASE.**

You: **E** `RETURN`
 P `RETURN`
Computer: **PHRASE #?**
You: **2** `RETURN`
Computer: **ERASE?**
You: **Y** `RETURN`

You're back with the music staves, ready to enter more music.

The first measure of **PHRASE 2** is a problem. Notice the number 3 over each of the groups of three notes in this measure. This means they are triplets. Triplets are three notes played in the time it would normally take to play two of the notes. The computer won't accept triplets as such, so you need to "fudge" a little. Think of the measure as rewritten in its (almost) equivalent form:

Now enter these revised twelve notes of the measure:

You: **C5S.** `RETURN`
 C5S. `RETURN`
 C5S. `RETURN`
 G4S. `RETURN`
 G4S. `RETURN`
 G4S. `RETURN`
 E4S. `RETURN`
 E4S. `RETURN`
 E4S. `RETURN`
 C4S. `RETURN`
 C4S. `RETURN`
 C4S. `RETURN`

When the computer played the measure after you entered the last note, it did not display the first eleven notes. It played all twelve notes but only displayed the last note. The screen was full, so it just tucked them away. If you want to see the notes, use the editing key to move the cursor back.

You: `CTRL` ←
 `CTRL` ←

The computer displays the first eleven notes of the measure. Now, go on to the last measure.

You: **M2** `RETURN`

Enter the five notes.

You: **G4E.** `RETURN`
 F4S `RETURN`
 EE. `RETURN`
 D4S `RETURN`
 CH `RETURN`

That does it! Go back to the Main Menu.

You: **S** `RETURN`
 S `RETURN`

Now you want to **LISTEN** to the music you've entered.

You: **L** `RETURN`

The computer played **PHRASE 1** and **PHRASE 2** together. You want to hear them played one after another. For this, you need to change the **ARRANGE** program.

B. ARRANGING MUSIC

When the computer is first turned on, the **ARRANGE** program is preset to play **PHRASES 1** to **4** together through **VOICES 1** to **4**. You want to hear **PHRASE 1**, then **PHRASE 2**. You don't want to hear them together yet.

First, zap the instruction that plays **PHRASE 2**. That's the first (and only) instruction in **VOICE 2**.

You: **A** `RETURN`
Computer: **VOICE #?**
You: **2** `RETURN`

Since this is the first time you've entered the **ARRANGE MUSIC** command, the computer displays the **ARRANGE MENU**. After this, it will only display the **ARRANGE MENU** when you type "**M** **RETURN** ". You want to go on.
You: HIT SPACE BAR

The computer displays the "**ARRANGE VOICE 2**" program. The only instruction in it is "**PLAY PHRASE 2**". You want to delete that instruction.
You: **CTRL** **↑**

This moved the dark colored line pointer—the cursor—up to line 1. Now zap the instruction.
You: **CTRL** **DELETE**

This leaves you with 20 empty program lines. Later, you will give **VOICE 2** some new instructions. But for now, go back to the Main Menu.
You: **S** **RETURN**

LISTEN to the music.
You: **L** **RETURN**

Only **PHRASE 1** played. You want **PHRASE 2** to play after **PHRASE** 1 plays.
You: **A** **RETURN**
Computer: **VOICE #?**
You: **1** **RETURN**

The computer displays the two steps of the "**ARRANGE VOICE 1**" program. You want to add a third step, to play **PHRASE 2**.
You: **P** **RETURN**
Computer: **PHRASE #?**
You: **2** **RETURN**

The computer enters "**PLAY PHRASE 2**" in line 3 of the **ARRANGE** program. Now, go back to the Main Menu and **LISTEN** to your music.
You: **S** **RETURN**
    L **RETURN**

The computer played both phrases and returned you to the Main Menu. Play it again, Sam.
You: **L** **RETURN**

That's nice, but this is really supposed to be a musical round. Each of the four voices should play one measure behind the previous voice. Since the phrases are two measures long, you need to enter one more **PHRASE** of music: a whole note rest. This will allow you to "play" one measure of silence.
You: **E** **RETURN**
    P **RETURN**
Computer: **PHASE #?**
You: **3** **RETURN**
Computer: **ERASE?**
You: **Y** **RETURN**

The computer displays the two empty music staves.
You: **RW** **RETURN**

A whole note rest is displayed.
You: **S** **RETURN**
    S **RETURN**

You are back in the Main Menu. **PHRASE** 3 now contains one measure of silence. Now you are ready to program your round. Here is the **ARRANGE** program you will enter:

VOICE 1	VOICE 2
1 DISPLAY	1 VOLUME MP
2 PLAY PHRASE 1	2 PLAY PHRASE 3
3 PLAY PHRASE 2	3 PLAY PHRASE 1
4 PLAY PHRASE 1	4 PLAY PHRASE 2
5 PLAY PHRASE 2	5 PLAY PHRASE 1
6 PLAY PHRASE 3	6 PLAY PHRASE 2
7 PLAY PHRASE 3	7
8 PLAY PHRASE 3	8
9	9

VOICE 3	VOICE 4
1 VOLUME MP	1 VOLUME MP
2 PLAY PHRASE 3	2 PLAY PHRASE 3
3 PLAY PHRASE 3	3 PLAY PHRASE 3
4 PLAY PHRASE 1	4 PLAY PHRASE 3
5 PLAY PHRASE 2	5 PLAY PHRASE 1
6 PLAY PHRASE 1	6 PLAY PHRASE 2
7 PLAY PHRASE 2	7 PLAY PHRASE 1
8	8 PLAY PHRASE 2
9	9

VOICE 1 will play the two Phrases of music twice. At reduced volume (Default volume is **MF**), the other voices will enter, each one meter (**PHRASE** 3) behind the previous voice. After each voice plays the two **PHRASES** of music twice, the voice is silent. The last voice to play is **VOICE** 4, which ends up the round by playing alone, just as **VOICE** 1 started playing alone. **VOICE** 1 is programmed to play **PHRASE** 3— the whole note rest—just so you can see it on the display.

Each voice's **ARRANGE** program is entered separately.

Start with **VOICE** 1.
You: **A** **RETURN**
Computer: **VOICE #?**
You: **1** **RETURN**

The computer displays the 20 program steps. The first 3 instructions are already entered, so you start with line 4.
You: **P** **RETURN**
    1 **RETURN**

Notice that each time you enter an instruction, the cursor moves down a line. New instructions are always entered at the cursor. If you make a mistake, you can use **CTRL** **↑** and **CTRL** **↓** to reposition the cursor, and reenter the proper instruction. If you do this, be sure to use the **CTRL** **↓** to move the cursor to the first empty line before continuing.

The cursor should now be at line 5. Enter the remaining program steps for **VOICE** 1.
You: **P** **RETURN**
    2 **RETURN**
    P **RETURN**
    3 **RETURN**
    P **RETURN**
    3 **RETURN**
    P **RETURN**
    3 **RETURN**

That's it for **VOICE** 1. Go back to the Main Menu, and **LISTEN**.
You: **S** **RETURN**
    L **RETURN**

Go on to **VOICE** 2.
You: **A** **RETURN**

Computer: **VOICE #?**
You: **2** **RETURN**

Enter the six program steps.
You: **V** **RETURN**
    MP **RETURN**
    P **RETURN**
    3 **RETURN**
    P **RETURN**
    1 **RETURN**
    P **RETURN**
    2 **RETURN**
    P **RETURN**

1 **RETURN**
P **RETURN**
2 **RETURN**

Go to the Main Menu, and **LISTEN**.
You: **S** **RETURN**
L **RETURN**

Enter the program for **VOICE** 3.
You: **A** **RETURN**
Computer: **VOICE #?**
You: **3** **RETURN**

The instruction in line 1 says "**PLAY PHRASE 3**". You want that in line 2, and "**VOLUME MP**" to be in line 1. For this, you move the cursor to line 1 and insert the **VOLUME** instruction.
You: **CTRL** ⬆

The cursor goes to line 1.
You: **CTRL** **INSERT**

The instruction in line 1 is moved down to line 2. The cursor remains at line 1, indicating this is where the next instruction will be entered.
You: **V** **RETURN**
MP **RETURN**

Your "**VOLUME MP**" instruction is entered in line 1, but the cursor remains there also. You must move the cursor down to the next empty line, line 3.
You: **CTRL** ⬇
CTRL ⬇

That puts the cursor at line 3. Now enter the remaining instructions for **VOICE** 3.
You: **P** **RETURN**
3 **RETURN**
P **RETURN**
3 **RETURN**
P **RETURN**
1 **RETURN**
P **RETURN**
2 **RETURN**
P **RETURN**
1 **RETURN**
P **RETURN**
2 **RETURN**

STOP, and **LISTEN**.
You: **S** **RETURN**
L **RETURN**

And, on to the fourth and last voice.
You: **A** **RETURN**
Computer: **VOICE #?**
You: **4** **RETURN**

You don't want instruction 1, "**PLAY VOICE 4**", at all. So delete it.
You: **CTRL** ⬆
CTRL **DELETE**

Enter your instructions for **VOICE** 4.
You: **V** **RETURN**
MP **RETURN**
P **RETURN**
3 **RETURN**
P **RETURN**
3 **RETURN**
P **RETURN**
3 **RETURN**

P **RETURN**
1 **RETURN**
P **RETURN**
2 **RETURN**
P **RETURN**
1 **RETURN**
P **RETURN**
2 **RETURN**

That's it! **STOP**, and **LISTEN**.
You: **S** **RETURN**
L **RETURN**

And **LISTEN** again.
You: **L** **RETURN**

You might try experimenting with your **ARRANGE** program by changing or inserting **VOLUME** levels, or by entering other program steps. But before you do that you'd better save your music onto your cassette or disk.

C. SAVING AND RETRIEVING MUSIC

From the Main Menu, the command "**S** **RETURN**" means "**SAVE**", not "**STOP**", as in the other sub-menus "**SAVE**" allows you to store your music onto your cassette or disk. "**RETRIEVE**" allows you to put that music back into the computer memory.

When you type "**S** **RETURN**", to **SAVE** music, the computer will display the "**SAVE MUSIC**" menu and ask "**FN?**". It wants a standard **ATARI** file name, such as "**C:**" for cassette, or "**D:ROWBOAT**" for disk. Refer to your operator manuals for further details. In this example, we assume you have a cassette. You start from the Main Menu.
You: **S** **RETURN**

The computer displays the **SAVE MUSIC** menu.
Computer: **FN?**
You: **C:** **RETURN**
Computer: **WHICH?**
You: **E** **RETURN**

The console beeps twice, you press **RECORD** and **PLAY** simultaneously on the Program Recorder, then hit **RETURN**

When the tape stops (Computer: **WHICH?**), You: **S** **RETURN** for **STOP**.
Computer: **FN?**
You: **S** **RETURN** to return to the Main Menu.
You: **STOP** the Program Recorder and rewind your cassette tape.

Your music is saved. The steps to **RETRIEVE** your music again are almost the same.
You: **R** **RETURN**

The computer displays the **RETRIEVE MUSIC** menu. This is the same as the **SAVE MENU**, except it says "**RETRIEVE MUSIC**" on the top line instead of "**SAVE MUSIC**". Again, the computer asks for a file name.
Computer: **FN?**
You: **C** **RETURN**
Computer: **WHICH?**
You: **E** **RETURN**

The console will beep once, at which time you start the cassette by pressing **PLAY** on the Program Recorder and hitting **RETURN**
You: **S** **RETURN**

Stop the cassette when the Main Menu is once again displayed on the screen. Your music has been entered again into memory, and you are ready to go.

III. PART THREE

THE MUSIC FILE STRUCTURE

A. GENERAL FILE FORMAT

The purpose of this section is to allow you to write or manipulate music files for the **MUSIC COMPOSER** in BASIC. It is a rather technical section, and before attempting it you should already be familiar with the **MUSIC COMPOSER** Cartridge, and with **ATARI BASIC**.

Files for the **MUSIC COMPOSER** contain up to three different types of records. The three types of records correspond to the **SAVE MUSIC** commands to save phrases, to save voices, and to save everything. Each of these records starts with a header byte, 170 (decimal), and ends with an end of record byte, 255. The last record in the file has an additional end of file byte, also 255.

Records may be in any order. The second byte of each record, right after the header byte, identifies which of the three record types it is, and thus how the record data bytes are to be interpreted.

B. PHRASE RECORD

A **PHRASE** record contains pitch and duration values for a given **PHRASE**. It is the actual program for playing the notes in one of the ten **MUSIC COMPOSER** phrases, and corresponds to the Enter Music command. When you **SAVE** or **RESTORE PHRASE** X, or **ALL PHRASES**, you are saving or restoring **PHRASE** records. Since there are ten possible **PHRASE** numbers, **0** or **9**, there can be up to ten different **PHRASE** records.

PHRASE records can be in any order, and can be mixed with the other records in any way. If the computer encounters more than one **PHRASE** record with the same **PHRASE** number, the last one read is the one used.

The **PHRASE** record format:

VALUE	INTERPRETATION
170	Header byte
0,2,4,6,8,10,12	Identifier byte
14,16,18	(even numbers only)
0-127	Pitch, Rest, or Measure byte
0-255	Duration byte
0-127	Pitch, Rest, or Measure byte
0-255	Duration byte
....	....
....	....
0-127	Pitch, Rest, or Measure byte
0-255	Duration byte
255	End Of Record byte

If the identifier byte is 18 or less, it identifies the record as a **PHRASE** record. Divide it by two for the correct **PHRASE** number. Thus, an identifier byte of **18** is **PHRASE 9**, 10 is **PHRASE 5**, and 0 is **PHRASE 0**.

The pitch byte is a combination of octave, letter name, and accidental information. The corresponding values for each of these parts of the pitch byte are:

Octave	Value
3	0
4	7
5	14
6	21

Letter name	Value
C	0
D	1
E	2
F	3
G	4
A	5
B	6

Accidental	Value
Natural	0
Sharp	1
Flat	2

To pack these three separate value items into a single byte, follow this formula:

Pitch = 4(Letter name value + Octave value) + Accidental value

Or, in **BASIC**:

10 PITCH = 4*(NAME + OCTAVE) + ACCIDENTAL

Do not attempt to give the computer note values above C of Octave 6 (pitch value 84), or you may lose data. Rests are denoted by a pitch value of 85. This would translate to C# of Octave 6, but since the computer can only play to C of Octave 6, there is no conflict. Pitch values of 127 indicate a measure bar is to be displayed on the screen.

Valid values for the pitch byte:

VALUE	INTERPRETATION
0-84	pitch from C, Octave 3 to C, Octave 6
85	rest
86	pitch of Cb, Octave 6
87-126	invalid
127	measure bar
128-254	invalid
255	end of PHRASE

Duration bytes, like pitch bytes, are actually a combination of three separate items of information:

NOTE	VALUE
Thirty-second	0
Sixteenth	2
Eighth	4
Quarter	6
Half	8
Whole	10
Tie (Legato)	128
no tie	0
Dot	1
no dot	0

The formula for the duration byte is:

Duration = Note value + Tie + Dot

Or, in **BASIC**:

10 DURATION = NVALUE + TIE + DOT

A duration value byte will always follow a pitch value byte, unless the pitch value byte is 255, end of **PHRASE**. If the pitch value byte is 127, a measure bar, then a duration byte must follow, but its value is ignored. It's a good idea to make the duration byte value also 127, so it will show up better when you examine the file data.

C. VOICE RECORD

A voice record is the actual program for playing one of the four voices. It corresponds to the **ARRANGE MUSIC** command. When you **SAVE** or **RETRIEVE VOICE** X, or **ALL VOICES**, you are saving or retrieving voice records.

There is one important difference between entering an **AR-RANGE** program with the **MUSIC COMPOSER** Cartridge, and writing a voice record file with **BASIC**: When you write a

voice record in **BASIC** you can have up to 127 program steps per voice (although only the first 20 steps — the limit of the **ARRANGE VOICE** command — will be displayed).

Like all the **MUSIC COMPOSER** records, the voice record starts with a header byte, 170, and ends with an end of record byte, 255. The identifier byte, directly following the header byte, identifies the record as a voice record and identifies the voice number, 1 to 4. The identifier byte for each of the four voices is:

VALUE	INTERPRETATION
20	ARRANGE VOICE 1
22	ARRANGE VOICE 2
24	ARRANGE VOICE 3
26	ARRANGE VOICE 4

Following the identifier byte are the command byte and the operand byte for each line of the **ARRANGE VOICE** program.

Voice records can be in any order and can be mixed with the other records in any way. If the computer encounters more than one voice record for the same voice, the last one read is the one used.

The voice record format:

VALUE	INTERPRETATON
170	Header byte
20,22,24,26	Identifier byte
0-6	Command byte
0-255	Operand byte
0-6	Command byte
0-255	Operand byte
....	....
....	....
0-6	Command byte
0-255	Operand byte
255	End of record byte

Note that there are no line numbers as such. The computer keeps track of line numbers by the position of the command-operand byte pair. The first is line 1, the 2nd is line 2, and so on.

Valid command bytes are the numbers 0-6. A command byte value greater than 6 will give unpredictable results, and may lose data.

Valid command bytes:

VALUE	INTERPRETATION
0	Null (empty line)
1	GOTO
2	PLAY PHRASE
3	TRANSPOSE
4	VOLUME
5	DISPLAY
6	COUNT

Valid operands are the same as the operands you would type in with the **ARRANGE VOICE** command, with three exceptions. First, you may **GOTO** a line greater than 20, up to line number 127. Second, negative numbers (such as in **TRANSPOSE**) are indicated by adding 128 to the absolute value. Thus, −1 is 129, −7 is 135. And the third exception is that the **VOLUME** designations O, PP, P, MP, MF, F, and FF become the numbers 0 to 7.

Also, be warned that the computer checks for errors only on input from the **ARRANGE VOICE** command. It does not check the data once it is entered in memory. So, invalid commands or operands from a **BASIC** generated voice record will very likely cause a system crash.

D. MISCELLANEOUS INFORMATION RECORD

There is only one miscellaneous information record, and its name is longer than it is. This record is used, along with **VOICE** and **PHRASE** records, only with the **SAVE** or **RETRIEVE EVERYTHING** commands. If the computer encounters more than one miscellaneous information record, the last one read is the one used.

The time signature, the tempo, and the key signature are the only information contained in this record. The miscellaneous information format:

VALUE	INTERPRETATION
170	Header byte
128	Identifier byte
2,4,8	Bottom number of time signature
9-2	Top number of time signature
0-255	Tempo
0-7, 128-135	Key signature
255	End of record

The first byte after the identifier byte, 128, is the bottom number of the time signature. It indicates which note gets a beat. This should be 2, 4, or 8, for half, quarter, or eighth notes. Other values will give unpredictable results.

The next byte is the top number of the time signature. It indicates the number of beats per measure. Valid numbers for this byte are 2 through 9, except for a time signature of 8/2 or 9/2. Again, invalid values give unpredictable results.

Any number is valid for the tempo byte. A value of 1 is the fastest tempo possible. The next slowest is 255, and 0 is the slowest.

The key signature byte is a value of 0-7 for the number of sharps, or a value of 0-7 plus 128 (128-135), for the number of flats.

E. A BASIC PROGRAM TO LIST MUSIC FILES

This very short **BASIC** program will enable you to list **MUSIC COMPOSER** files on the screen as blocks of numbers. It is useful for examining files generated by the **MUSIC COMPOSER** Cartridge, and for debugging files you have created with external programs.

Since **ATARI BASIC** has different file handling routines for cassette and for disk, the first few lines of the program are different for the two types of media.

If you have a cassette:

```
10 REM DUMP MUSIC COMPOSER FILES
20 REM
30 REM OPEN CASSETTE FILE
40 REM
50 DIM Q$(1):OPEN#3,4,0,"C:"
```

And if you have a disk:

```
10 REM DUMP MUSIC COMPOSER FILES
20 REM
22 REM OPEN DISK FILE
24 REM
30 DIM FILE$(14),Q$(1)
40 PRINT "FILE NAME";:INPUT FILE$
50 OPEN #3,4,0,FILE$
```

The remainder of the program is identical for either cassette or disk.

```
60 REM
70 REM LOOK FOR RECORD START (170)
80 IF END BYTE (255) THEN EXIT
90 REM
100 GET#3,BYTE
```

```
110 IF BYTE=255 THEN PRINT "255 (END OF FILE)";:END
120 IF BYTE < >170 THEN 100
125 PRINT:PRINT BYTE;" ";:GET #3,BYTE
130 REM
140 REM PRINT RECORD BYTE
150 REM
160 IF BYTE<20 THEN PRINT BYTE;" (PHRASE RECORD -
    PHRASE # ";BYTE/2;")":GOTO 210
170 IF BYTE < 27 THEN PRINT BYTE;" (VOICE RECORD -
    VOICE # ";(BYTE-20)/2+1;")":GOTO 210
180 PRINT BYTE;" (MISC. INFO. RECORD)"
190 REM
200 REM FETCH RECORD DATA
205 REM
210 GET #3,BYTE:IF BYTE = 255 THEN PRINT BYTE:INPUT
    Q$:GOTO 100
220 PRINT BYTE;" ";:GOTO 210
```

A sample program run follows. User inputs are in square brackets.

[RUN `RETURN`]
FILE NAME?[D:DUMMY.MUS `RETURN`]

170 128 (MISC. INFO. RECORD)
4 4 0 1 255?[`RETURN`]

170 22 (VOICE RECORD - VOICE #2)
2 0 255?[`RETURN`]

170 20 (VOICE RECORD - VOICE #1)
5 1 2 1 255?[`RETURN`]

170 2 (PHRASE RECORD - PHRASE #1)
127 127 4 11 127 127 0 11 255?[`RETURN`]

170 0 (PHRASE RECORD - PHRASE #0)
127 127 85 9 32 9 127 127 36 9 28 9 255?[`RETURN`]
255 (END OF FILE)
READY

The first byte of each record is always 170, the record header byte. In the sample run, the second byte found was 128, which identifies the record as a Misc. Info. record. The next two bytes indicate a time signature of 4/4. Tempo, the next byte, is one. Next, the key signature is 0 for 0 sharps, or C Major. And the last byte is 255, end of record.

The second record is identified as a Voice Record for Voice #2. There are only two data bytes in the record, 2 and 0. The first of these, 2, is the command byte to Play PHRASE; and the second byte, 0, is the operand byte, PHRASE 0. Instructions in the four data bytes of the next record, Play PHRASE #1, are to Display (5) Voice #1 (1), and to Play (2) Voice #1 (1).

Note that the data in the final two records, PHRASE record #1 and PHRASE record #2, start with the measure bar bytes, 127 127. PHRASE records must always start with measure bar bytes, or the computer becomes confused on how to display the notes.

When an end of record byte, 255, is followed by a second value of 255, this is recognized as an end of file, and the program ends.

F. SAMPLE BASIC COMPOSING PROGRAMS

These next two programs are included here as a guide for using **BASIC** with the **MUSIC COMPOSER** Cartridge. They are intended as guidelines only, and are not necessarily efficient in all cases, or even debugged. You can do better.

First is a fairly short program to write notes randomly, but with a few simple rules.

```
5 REM BASIC NOTE-WRITING PROGRAM
7 REM
10 REM
```

```
12 REM OPEN DISK FILE
14 REM
20 DIM FILE$(14)
30 ? "FILE NAME";:INPUT FILE$
40 ? "MEASURES/PHRASE";:INPUT MAXM
40 ? "MEASURES/PHRASE";:INPUT MAXM
50 OPEN #3,8,0,FILE$
60 REM
64 REM WRITE PHRASE RECORDS 0-9
66 REM
70 PITCH=16:OPITCH=PITCH:ORANGE=2
80 FOR I=0 TO 9:PUT #3,170:PUT #3,I*2:PU
T #3,127:PUT #3,127:? :? I;
90 MAX=RND(X)*MAXM
100 REM
104 REM SELECT DURATION
105 REM
110 RANGE=INT(RND(X)*4)
115 IF ABS(RANGE-ORANGE)>1 THEN 110:ORAN
GE=RANGE
120 IF RANGE-DUR=RANGE THEN IF RND(X)>0.
5 THEN 210
130 DUR=INT(RND(X)*3)
140 IF DUR=2 THEN IF RND(X)>0.5 THEN 130

150 DUR=DUR+RANGE
200 REM
204 REM SELECT PITCH
206 REM
210 PITCH=INT(RND(X)*8):IF DUR>1 THEN PI
TCH=INT(PITCH/2)*2
220 PITCH=PITCH+INT(RND(X)*3)*7
230 IF ABS(OPITCH-PITCH)>5 THEN 210
240 IF TIE THEN IF OPITCH=PITCH THEN 210

250 OPITCH=PITCH:PP=PITCH*4
260 TIE=0:IF RND(X)>0.9 THEN TIE=128
300 REM
304 REM MEASURE CHECK
305 REM
310 ? ".";
320 DURAMT=INT(2^DUR+0.5)
330 IF DURAMT+MEASURE<32 THEN MEASURE=DU
RAMT+MEASURE:GOTO 410
340 IF DURAMT+MEASURE>32 THEN DUR=DUR-1:
GOTO 320
350 MEASURE=0:MAX=MAX-1
360 PUT #3,PP:PUT #3,DUR*2+1
370 ? "/";:PP=127:DUR=63
400 REM
404 REM SEND TO FILE
405 REM
410 PUT #3,PP:PUT #3,DUR*2+1+TIE
420 IF MAX>0 THEN 120
430 IF MEASURE>0 THEN 120
440 PUT #3,255:NEXT I
450 REM
460 REM WRITE VOICE #1 RECORD TO
464 REM DISPLAY & PLAY PHRASES 0-9
466 REM
470 PUT #3,170:PUT #3,20
480 PUT #3,5:PUT #3,0
```

```
490 FOR I=0 TO 9:PUT #3,2:PUT #3,I:NEXT
I:PUT #3,255
500 REM
510 REM ZAP VOICE #'S 2-4
520 REM
530 FOR I=2 TO 6 STEP 2:PUT #3,170
540 PUT #3,(20+I)
550 PUT #3,255:NEXT I:PUT #3,255
```


This next program is an adaptation of the Harmony program presented by John G. Kemeny and Thomas Kurtz in their book "BASIC Programming". The program is discussed in detail in this book. It's one of the best books on **BASIC** programming, and is written by the originators of the language. Briefly, the program asks for PHRASE numbers as input. Any number of phrases can be given, in any order. Phrases may also be repeated. When a PHRASE number >9 is given, the program stops asking for input and starts to calculate the harmony lines. It shifts all the melody phrases to the top octave and writes that into PHRASE #1, the three harmony lines are put into PHRASE records 2,3 and 4.

Note that this program, as written, will not work with a cassette, as it requires multiple accesses of the same PHRASE record. Also, it only "understands" PHRASE records. So its input may not contain Voice records, or Misc. Info. records. Once again, this is not an ideal program. It is included here to give you an idea of some of the possibilities of writing your own **MUSIC COMPOSER** files in **BASIC**. Good luck!

```
5 NN=200:REM SET TO MOST NOTES USED
10 DIM INFILE$(14),OUTFILE$(14),B(3),D(3
),W(3,6),P(6,6),PHR(30)
12 ? "INPUT FILE NAME";:INPUT INFILE$
14 ? "OUTPUT FILE NAME";:INPUT OUTFILE$
20 ? "PHRASE NUMBER (10 TO END)";:INPUT
X:PHR(I)=X:I=I+1:IF X<10 THEN 20
44 DIM M(NN+1),DUR(NN+1),BAR(NN+1)
46 DIM SOP(NN+1),ALT(NN+1),TENOR(NN+1),B
ASS(NN+1),S(5,NN+1)
```

```
50 CLOSE #4:OPEN #4,4,0,INFILE$
52 GET #4,X:IF X=255 THEN GET #4,X:IF X=
255 THEN 70
54 IF X<>170 THEN 52
56 GET #4,X:IF X<(PHR(K)*2) THEN 52
58 GET #4,X
60 BAR(N)=0:IF X=127 THEN GET #4,X:GET #
4,X:BAR(N)=127
64 IF X=255 THEN 70
66 N=N+1:M(N)=X:GET #4,X:DUR(N)=X
68 GOTO 58
70 K=K+1:IF PHR(K)<10 THEN 50
72 NN=N
76 REM
77 REM INITIALIZE CHORD DATA
78 REM
80 FOR I=1 TO 6:FOR J=1 TO 6
90 READ P:P(I,J)=P:NEXT J:NEXT I
110 DATA 5,4,1,6,2,3,6,4,2,1,5,3,6,4,3,1
,2,5,1,5,4,6,3,2,2,6,5,4,1,3,1,5,3,6,2,4

136 REM
137 REM CONVERT MELODY VALUES 0-7
138 REM
140 FOR I=1 TO NN:X=INT(M(I)/4)
144 IF X>21 THEN X=INT(RND(X)*8)
146 IF (X-15*INT(X/15))=14 THEN M(I)=7:G
OTO 148
147 M(I)=X-7*INT(X/7)
148 NEXT I:M(NN)=0
194 FOR I=0 TO 4:READ X
200 S(I,NN)=X:NEXT I
220 DATA 1,0,-3,-5,-7
230 C2=1
240 REM
450 FOR N=NN TO 1 STEP -1
460 IF N=NN THEN 6000
470 REM
500 REM TEST CHORDS
502 REM
505 I1=1
510 FOR I=I1 TO 6
515 TRAP 5020
520 C2=P(C1,I)
525 S(0,N)=C2
530 S=M(N)
540 S(1,N)=S
542 REM
545 REM FIX ROOT
547 REM
550 D(1)=C2-8
560 D(2)=C2-15
565 D=S(4,N+1)
570 FOR J=1 TO 2
580 IF (ABS(D(J)-D)<=5 THEN 610
590 R=D(3-J)
600 GOTO 660
610 NEXT J
620 IF S>S(1,N+1) THEN 650
630 R=D(1)
640 GOTO 660
650 R=D(2)
```

```
660 S(4,N)=R
700 REM
701 REM FIND OTHER NOTES
702 REM
705 J=1
710 FOR K=0 TO 4 STEP 2
720 X=S-(R+K):IF (X-7*INT(X/7))=0 THEN 7
50
730 B(J)=R+K
740 J=J+1
750 NEXT K
760 IF J>3 THEN 4000
770 REM
800 FOR L=0 TO 6
810 A=B(1)
820 B=B(2)
830 W(0,L)=0
840 W(2,L)=B
850 W(3,L)=A
860 B(1)=B
870 B(2)=A+7
880 NEXT L
1000 REM
1001 REM TEST CASES IN W-TABLE
1002 REM
1010 FOR L=0 TO 6
1020 FOR V=2 TO 3
1030 B=W(V,L)
1040 IF ABS(B-S(V,N+1))>5 THEN 1260
1050 IF B>(17-4*V) THEN 1260
1060 IF B<(5-4*V) THEN 1260
1070 S(V,N)=B
1080 IF S(2*V-3,N)<=S(2*V-2,N) THEN 1260

1090 NEXT V
1095 REM
1100 REM CHECK FOR BAD TRANSITIONS
1101 REM
1102 IF C1=C2 THEN 1200
1105 FOR V1=1 TO 4
1110 FOR V2=V1+1 TO 4
1115 D=S(V1,N+1)-S(V2,N+1)
1117 X=D-7*INT(D/7)
1120 IF X=0 THEN 1145
1130 IF X=4 THEN 1145
1140 GOTO 1160
1145 S1=S(V1,N)-S(V1,N+1)
1150 S2=S(V2,N)-S(V2,N+1)
1155 IF S1=S2 THEN 1260
1160 NEXT V2
1165 NEXT V1
1200 REM
1202 REM COMPUTE DISTANCE
1204 REM
1210 FOR V=2 TO 3
1220 D(V)=ABS(S(V,N)-S(V,N+1))
1230 NEXT V
1240 W(0,L)=D(2)+D(3)
1250 GOTO 1261
1260 W(0,L)=999
1261 NEXT L
1500 REM
1502 REM SELECT NEXT CHORD
1504 REM
1510 M=999
1520 FOR L=0 TO 6
1530 M1=W(0,L)
1540 IF M1>M THEN 1590
1550 M=M1
1560 L9=L
1590 NEXT L
1595 REM
1600 IF M=999 THEN 4000
1610 S(2,N)=W(2,L9)
1620 S(3,N)=W(3,L9)
1630 GOTO 6000
3990 REM
3995 REM REJECT CHORD, TRY NEXT ONE
4000 REM
4001 NEXT I
5000 REM
5001 REM BACK UP
5002 REM
5005 N=N+1
5010 IF N<>NN THEN 5100
5020 PRINT "STUCK (UNABLE TO WRITE HARMO
NY)"
5030 END
5100 C2=S(0,N)
5110 C1=S(0,N+1)
5120 FOR I=1 TO 6
5130 IF C2=P(C1,I) THEN 5200
5140 NEXT I
5200 I1=I+1
5210 GOTO 510
5220 REM
6000 REM
6002 REM PRINT RESULTS
6004 REM
6006 ? ".";
6010 SOP(N)=S(1,N)+14:ALT(N)=S(2,N)+14:T
ENOR(N)=S(3,N)+14:BASS(N)=S(4,N)+14
6015 IF BASS(N)<0 THEN BASS(N)=BASS(N)+7

6020 C1=C2:NEXT N
6030 REM
6032 REM SEND TO OUT FILE
6034 REM
6040 OPEN #3,8,0,OUTFILE$
6050 FOR I=1 TO 4
6070 PUT #3,170:PUT #3,(I*2)
6080 PUT #3,127:PUT #3,127
6090 FOR K=1 TO NN
7000 IF I=1 THEN PP=SOP(K):A=221
7010 IF I=2 THEN PP=ALT(K):A=ALT(K+1)
7020 IF I=3 THEN PP=TENOR(K):A=TENOR(K+1
)
7030 IF I=4 THEN PP=BASS(K):A=BASS(K+1)
7034 TIE=0:IF PP=A THEN IF DUR(K)<128 TH
EN TIE=128
7040 PUT #3,(PP*4):PUT #3,(DUR(K)+TIE)
7120 IF BAR(K)>0 THEN PUT #3,127:PUT #3,
127
7130 NEXT K:PUT #3,255:NEXT I:PUT #3,255
```

IV. PART FOUR

QUICK GUIDE TO THE ATARI MUSIC COMPOSER CARTRIDGE

A. COMMANDS FROM THE MAIN MENU

Command: EDIT MUSIC
Prompt: WHICH?
Syntax: E `RETURN`
Display: EDIT MUSIC Menu.
Action: Allow changes to existing music.

Command: ARRANGE MUSIC
Prompt: WHICH? VOICE#?
Syntax: A `RETURN` (1-4) `RETURN`
Display: ARRANGE MENU when first called, AR-RANGE VOICE program thereafter.
Action: Write or change the program that plays music through the four voices.

Command: SAVE
Prompt: WHICH? FN?
Syntax: S `RETURN` (C: or D:FILENAME)
Display: SAVE MUSIC Menu.
Action: Allow music in memory to be saved onto external media (cassette, disk).

Command: RETRIEVE
Prompt: WHICH? FN?
Syntax: R `RETURN` (C: or D:FILENAME) `RETURN`
Display: RETRIEVE MUSIC Menu.
Action: Allow music on external media to be put into memory.

Command: DOS
Prompt: WHICH?
Syntax: D `RETURN`
Display: DOS menu.
Action: Enter DOS.

Command: LISTEN
Prompt: WHICH?
Syntax: L `RETURN`
Display: Music staves; notes as programmed.
Action: Play music through the four voices as programmed by ARRANGE MUSIC.

B. COMMANDS FROM EDIT MUSIC

Command: PHRASE
Prompt: WHICH? PHRASE #? ERASE? MEASURE #?
Syntax: P `RETURN` (0-9) `RETURN` (Y-N) `RETURN` (MEASURE #) `RETURN`
Display: Music staves of MEASURE and PHRASE selected. Music input menu.
Action: Allow type-in and change of music, as in "New music", but do not erase PHRASE.

Command: METER
Prompt: WHICH? NEW METER?
Syntax: M `RETURN` (beats)/(note) `RETURN`
(beats) = beats per measure: 2-9.
(note) = which note gets a beat: 2, 4, 8.
Note: 8/2 and 9/2 are not allowed.
Display: METER status changes to new time signature.
Action: Sets time signature. Has no effect on how the music is actually played.

Command: CHECK MEASURES
Prompt: WHICH?
Syntax: C `RETURN`
Display: CHECK MEASURES status changes from "OFF" to "ON", or vice-versa.
Action: When "ON", and in music input menu, checks for the proper number of beats per measure.

Command: KEY SIG.
Prompt: WHICH? NEW KEY SIG.?
Syntax: K `RETURN` (0-7) (S-F) `RETURN`
(0-7) = number of sharps or flats.
(S-F) = S for Sharps, F for Flats.
Display: KEY status changes to reflect new KEY.
Action: Displays music in NEW KEY.

Command: TEMPO
Prompt: WHICH? NEW TEMPO?
Syntax: T `RETURN` (1-9) `RETURN`
Display: TEMPO status changes to reflect new TEMPO. (1 = fastest, 9 = slowest)
Action: Changes overall TEMPO of music.

Command: STOP
Prompt: WHICH?
Syntax: S `RETURN`
Display: Main Menu.
Action: Exit from EDIT MUSIC Menu to Main Menu.

Commands From MUSIC Display

Command: STOP
Prompt: SMI, NOTE?
Syntax: S `RETURN`
Display: EDIT MUSIC menu.
Action: Exit to EDIT MUSIC menu.

Command: MEASURE
Prompt: SMI, NOTE?
Syntax: Mx `RETURN`
Note: 'x' is next measure number or any previously entered measure. If 'x' is omitted, next measure number is assumed.
Display: MEASURE 'x'.
Action: Move to MEASURE 'x', display the MEASURE and, if there are any notes in it, play them. If 'x' is the current MEASURE number, it is replayed.

Command: INSERT MEASURE
Prompt: SMI, NOTE?
Syntax: I `RETURN`
Display: Current MEASURE, but empty of notes.
Action: Starting with the current MEASURE, move all MEASURES up one MEASURE number. Leave new current MEASURE empty of notes.

Command: enter next NOTE
Prompt: SMI, NOTE?
Syntax: (general examples):
LETTER (ACCIDENTAL) [OCTAVE] DURATION (DOT) (TIE)
LETTER: C, D, E, F, G, A, B, R (Rest)
ACCIDENTAL (optional): S-Sharp, F-Flat, N-Natural (If omitted, assumes natural value or that specified by key signature)
OCTAVE [if omitted, last octave is used]: 3, 4, 5, 6
DURATION: W-Whole note
H-Half note
Q-Quarter note
E-Eighth note
S-Sixteenth note
T-Thirty-second note

Syntax

DOT (optional): period (".")
TIE (optional): T
(examples):
CS4E.T `RETURN`
CNQ `RETURN`
RW `RETURN`

Display: Current MEASURE, with entered note. Cursor moves behind entered note.
Action: Enter note directly in front of cursor. Play MEASURE.

C. COMMANDS TO ARRANGE MUSIC

Command: COUNT
Prompt: CDGMPSTV? COUNT#?
Syntax: C `RETURN` (1-127) `RETURN`
Display: "COUNT XXX" at last cursor position.
Action: COUNT instruction entered into program. The next GOTO instruction will loop XXX times.

Command: DISPLAY
Prompt: CDGMPSTV?
Syntax: D `RETURN`
Display: "DISPLAY" at last cursor position.
Action: Current VOICE is displayed on screen, until another VOICE gives DISPLAY instruction.

Command: GOTO
Prompt: CDGMPSTV? LINE#?
Syntax: G `RETURN` (1-20) `RETURN`
Display: "GOTO XX" at last cursor position.
Action: ARRANGE program loops to line XX. If a COUNT number was previously given, GOTO loops that many times, then continues to the next instruction. If no COUNT instruction was previously given, GOTO loops continuously.

Command: MENU
Prompt: CDGMPSTV?
Syntax: M `RETURN`
Display: ARRANGE Music MENU.
Action: Displays the ARRANGE Music MENU, to decode the magic word "CDGMPSTV?". Type any key to return to the ARRANGE VOICE program.

Command: PLAY PHRASE
Prompt: CDGMPSTV? PHRASE#?
Syntax: P `RETURN` (0-9) `RETURN`
Display: "PLAY PHRASE X" at last cursor position.
Action: Plays the PHRASE through the current VOICE.

Command: STOP
Prompt: WHICH?
Syntax: S `RETURN`
Display: Main Menu.
Action: Exit from ARRANGE VOICE to Main Menu.

Command: TRANSPOSE
Prompt: CDGMPSTV? # 1/2 STEPS?
Syntax: T `RETURN` (−36 to 36) `RETURN`
Display: "TRANSPOSE XX" at last cursor position.
Action: All music in current VOICE is transposed, until another TRANSPOSE instruction is given.

Command: VOLUME
Prompt: CDGMPSTV? VOLUME?
Syntax: V `RETURN` (0, PP, P, MP, MF, F, FF)
`RETURN`

Display: "VOLUME XX" at last cursor position.
Action: New VOLUME is set for all music in the current VOICE, until another VOLUME instruction is given.

D. COMMANDS TO SAVE OR RETRIEVE MUSIC

Command: E EVERYTHING
Prompt: WHICH?
Syntax: E `RETURN`
Display: Main Menu, after end-of-file.
Action: All PHRASES, all VOICE programs, and the EDIT MUSIC data are Saved/Retrieved.

Command: AP ALL PHRASES
Prompt: WHICH?
Syntax: AP `RETURN`
Display: Main Menu, after end-of-file.
Action: ALL PHRASES are Saved/Retrieved.

Command: AV ALL VOICES
Prompt: WHICH?
Syntax: AV `RETURN`
Display: Main Menu, after end-of-file.
Action: ALL ARRANGE VOICE programs are Saved/Retrieved.

Command: Px PHRASE x
Prompt: WHICH?
Syntax: P(0-9) `RETURN`
Display: Main Menu, after end-of-file.
Action: PHRASE x (0-9) is Saved/Retrieved.

Command: Vx VOICE x
Prompt: WHICH?
Syntax: V(1-4) `RETURN`
Display: Main Menu, after end-of-file.
Action: ARRANGE VOICE x (1-4) is Saved/Retrieved.

Command: STOP
Prompt: WHICH?
Syntax: S `RETURN`
Display: Main Menu.
Action: Exit from SAVE/RETRIEVE to Main Menu.

E. RECORD FILE FORMATS

Miscellaneous Information Format:

VALUE	INTERPRETATION
170	Header byte
128	Identifier byte
2,4,8	Bottom number of time signature
2-9	Top number of time signature
0-255	Tempo
0-7, 128-135	Key signature
255	End of record

Phrase Record Format:

VALUE	INTERPRETATON
170	Header byte
0-18	Identifier byte (even values only)
0-127	Pitch, Rest, or Measure byte
0-255	Duration byte
0-127	Pitch, Rest, or Measure byte
0-255	Duration byte
....	....
....	....
0-127	Pitch, Rest, or Measure byte
0-255	Duration byte
255	End of record byte

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